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MOHAWK ENERGY

Expandable Tubular Technology



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Company

Mohawk Energy is an independent, privately owned company, dedicated to the development, manufacture and installation of expandable tubular products, which provide real value for operators in the oil and gas industry by the application of practical technology. **Mohawk's** unique expandable technology allows operators to minimize or, in some cases, completely eliminate borehole tapering issues by in-situ radial expansion of tubulars in the wellbore.

Through the company's design, development, testing and service capabilities, and relationships with a select group of supply and manufacturing companies, **Mohawk Energy** will launch a steady flow of cutting-edge expandable products at patterned release dates over the coming months and years, each with the potential to build unique value for the operator.

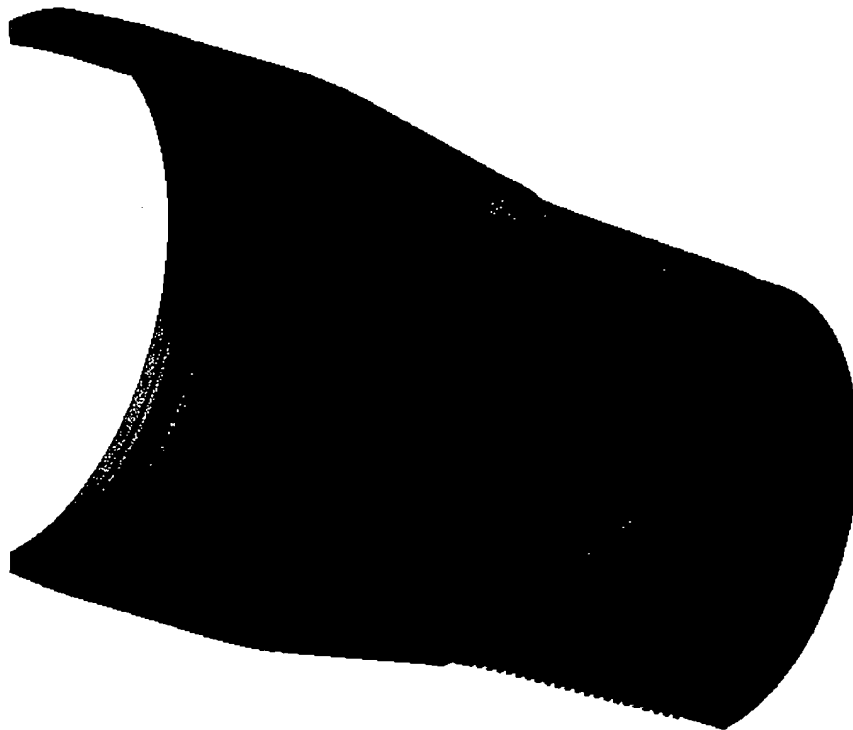
The extensive experience of **Mohawk Energy's** leadership team in development and implementation of expandable tubular systems will enable the operator to maximize value from expandable technology in the oil and gas industry.



Expandable Casing

Mohawk Energy has developed manufacturing specifications for a family of different sizes of seamless, expandable tubular products. The tubulars, having yield strengths in the range of 50-80 KSI, have been tested to expansion ratios of up to 25%. Both metal-to-metal seal and elastomeric seal expandable connectors have been developed and tested to expansion ratios of up to 20%. The proprietary lubricant-coating system provides excellent corrosion resistance, a low coefficient of friction, and temperature performance up to 300°F.

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Expansion System

The Mechanical Tractor Expansion (MTX) System provides the necessary propagation force for radial expansion of tubulars downhole. The system has been designed to utilize a working expansion pressure of 3,000-3,500 PSI, which allows the use of standard rig floor equipment. The expansion speed of the MTX system is 5-10 feet/minute under a continuous supply of fluid through the drill pipe.

The MTX system has the following advantages

- Greater expansion diameter, i.e. the ID of the expanded tubular can be the same as the drift diameter of the previous casing, which provides opportunities for new expandable products such as “Open Hole Mono-Clads”
- Expansion is done directly against the borehole, which eliminates the need for cementation.
- System can be set-up to expand in either Top-Down or Bottom-Up modes.
- Reliability/Contingency
 - Expansion tool can be retrieved and redeployed at any point in Top-Down expansion mode.
 - No risk of cement setting.
 - Safe Pop-Out.
- No Drill-Out necessary because the system contains neither launcher nor casing shoe.

Products

Open Hole Mono-Clad (OHMC)

The OHMC system can solve problems such as lost circulation, shallow water, water shut-off, high pressure zones, and other borehole stability problems. **Mohawk's** unique OHMC solution allows mitigation of problem zones *without losing borehole diameter*, i.e. the ID of expanded OHMC is the same as the hole diameter, and therefore further drilling can be of the same hole diameter (see Figs. 1-3). Additionally, **Mohawk's** OHMC system allows mitigation of *multiple* problem zones while drilling. This technique allows minimization of the number of casing strings which can enable the operator to reach the geological objective and/or make the well more economical.

Cased Hole Clad (CHC)

The CHC system is suitable for cost effective repair or reinforcement of damaged or worn casing, deeper drilling or to shut off perforations in production casing for re-completion operations. **Mohawk's** CHC system uniquely allows lining of the casing with different diameters, (i.e. if the lower portion of casing has a higher weight than the upper portion) which allows minimization of the annulus between the old casing and the clad (see Fig. 4).

Open Hole Liner System (OHLS)

The OHLS provides cost effective solutions for both planned and contingency operations. The OHLS allows installation of casing strings with minimal reduction in inside diameter which allows the drilling of wells with complex lithology and makes wellbore extensions possible using existing wells. **Mohawk's** OHLS allows expansion to be performed directly against the borehole wall, which eliminates the need for under-reaming and cementation (see Fig. 5). The OHLS can be used in Top-Down or Bottom-Up configurations.

Patent pending technology

Mohawk Energy has filed five patent applications in the areas of expandable connectors, expandable tool systems, and zonal isolation systems.

Management team

Andrei Filippov, President

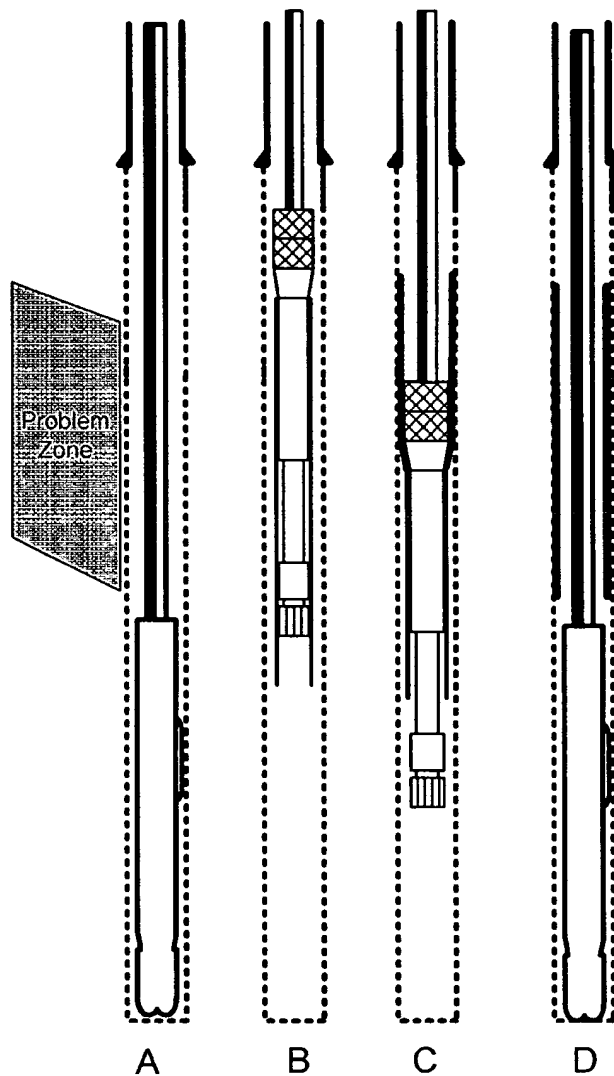
Andrei, previously a technical advisor at Shell Oil Co., has been involved in research and development of expandable tubular systems from the inception of the technology in 1997. He has authored and coauthored more than 50 patents in the area of expandable tubulars. Andrei joined **Mohawk Energy** in July 2005. His education includes a Ph.D. in Mechanics and Material Science from University of Massachusetts.

Scott Benzie, Vice President of Technology and Engineering

Scott is a chartered engineer who began his career as a downhole tool designer and became involved with expandables at Baker Hughes in 1998. He continued with a Baker Hughes and Shell joint venture in expandables before joining Shell International E&P, as Project Leader for Monodiameter Well Technology Development. Scott joined **Mohawk Energy** in August 2004. He has a BEng (Hons) in Mechanical Engineering from Heriot-Watt University in Edinburgh.

Dimitri Filippov, Vice President of Business Development

Dimitri has developed and managed marketing and distribution channels for high pressure water jetting equipment in the CIS for Butterworth Jetting Systems, Inc. Prior to joining **Mohawk Energy**, he provided valuation and litigation consulting services at Hill Schwartz Spilker Keller LLC. He has BS and MBA degrees from Texas A&M University and a JD from the University of Houston Law Center.



- A - Drill (RWD) hole
 $D = \text{ID}(\text{previous casing}) + 2(\text{wall thickness of clad})$;
- B - Deploy clad;
- C - Expand to ID of previous casing;
- D - Keep drilling same size hole.

ADVANTAGES

- * **MULTIPLE Clads**
as you drill
- * No cement
- * Contingency: Tool can be retrieved and redeployed at any point
- * Expansion can be accomplished even if tubing/connector leak occur

CONSTRAINTS

- * Rat hole (~40 ft.) for tool exit in Top-Down mode

**Fig. 1 - OPEN HOLE MONOCLAD
with Ream While Drilling Bit**

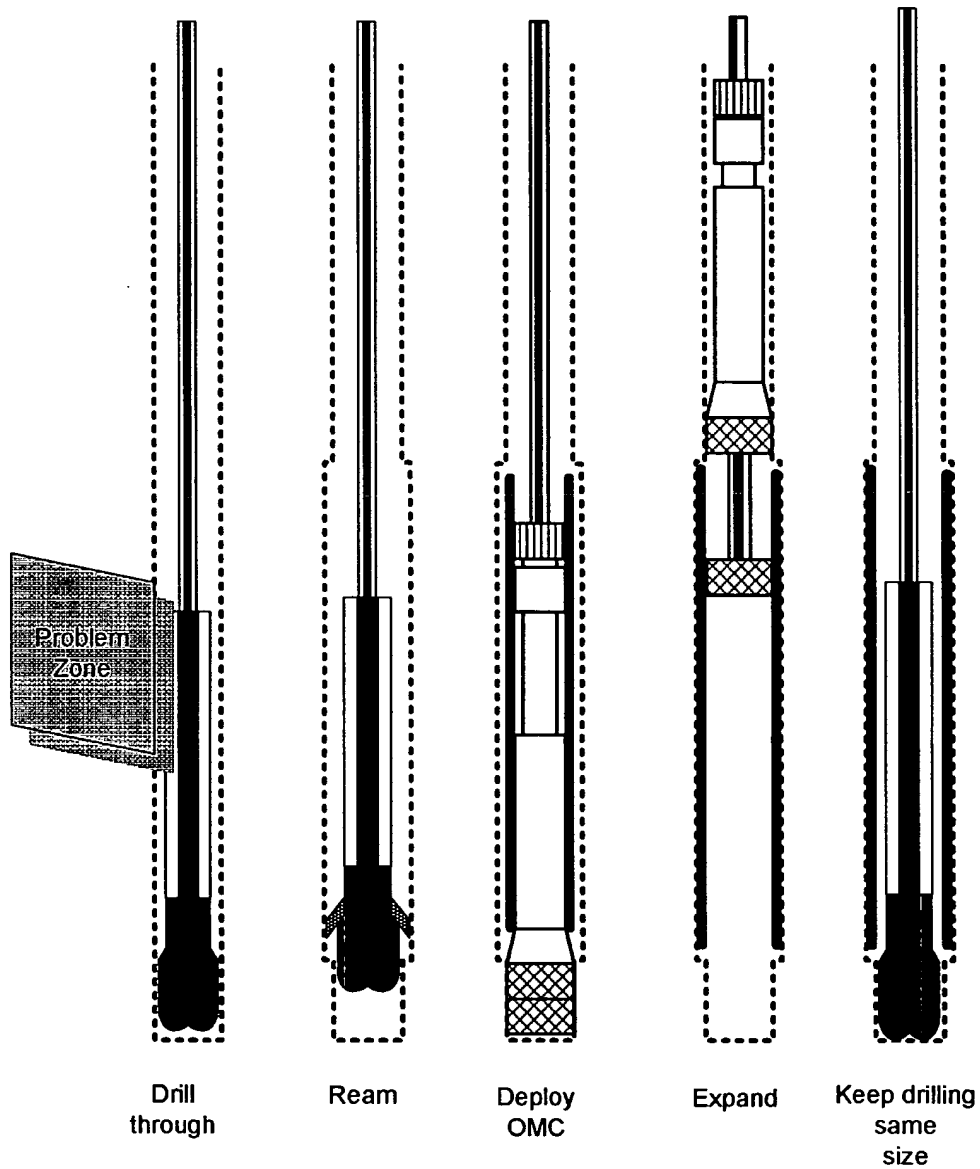
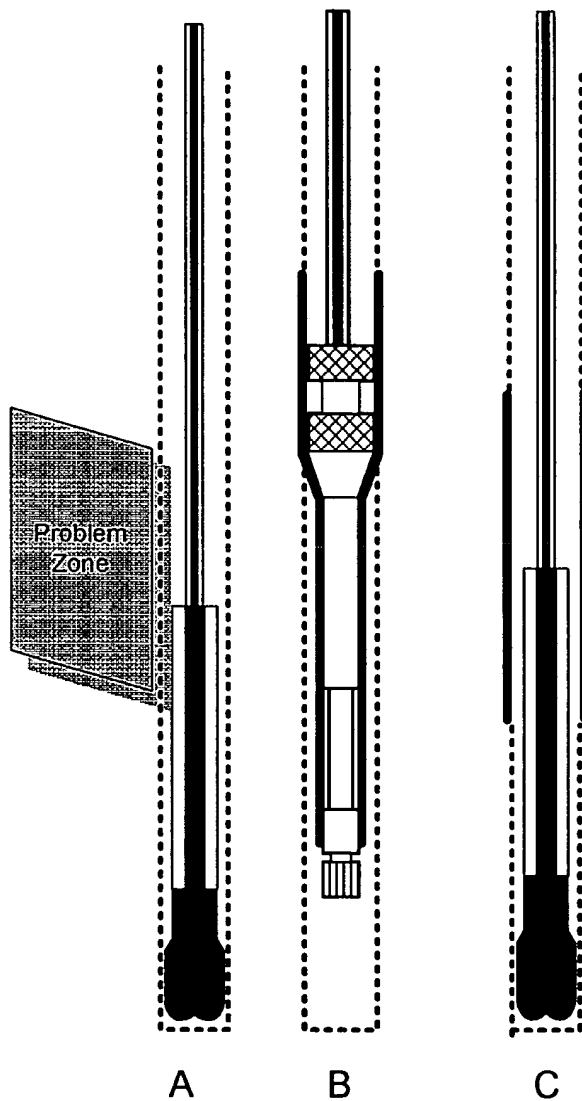


Fig. 2 – OPEN HOLE MONOCLAD with Regular Bit



- A - Drill Through a Problem Zone;
- B - Deploy Clad and expand Into-Formation: ID=Dhole;
- C - Keep drilling same hole diameter.

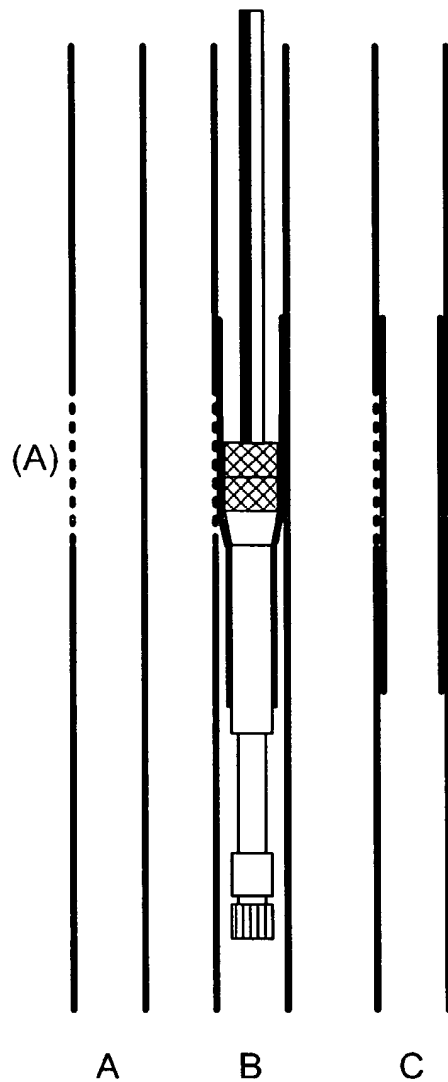
ADVANTAGES

- * No reaming, regular drill-bit
- * Multiple clads
- * No Cement

LIMITATIONS

- * Soft Formation ($E < 0.8E+05$) or shallow depth

**Fig. 3 – OPEN HOLE MONOCLAD
for Shallow\Soft formation**



A - Locate (A) damaged, corroded, worn area of casing or leaking connector;

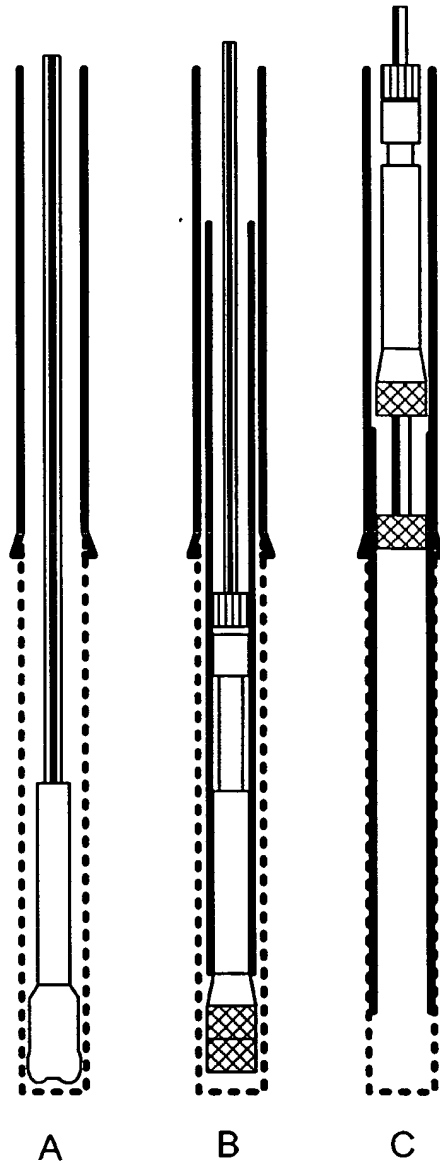
B - Deploy clad and expand in Top-Down configuration;

C - Remove expansion tool.

ADVANTAGES

- * **MULTIPLE** sequential clads can be installed
- * Same clad can be expanded to several different diameters
- * **Contingency**: Expansion Tool can be retrieved and redeployed at any point

Fig. 4 – CASED HOLE CLAD



A - Drill a Hole (D=Drift of previous casing);

B - Deploy Tubular with Expansion system;

C - Expand in Bottom-Up or Top-Down mode.

ADVANTAGES

- * No Under-Reaming
- * No Cement
- * Safe Pop-Out
- * Reliability
 - expansion can be accomplished even if tubular/connector leaks occur
 - No risk to get stuck due to cement set-up
- * Contingency: in Top-Down mode tool can be removed and redeployed at any point

CONSTRAINTS

- * Rat hole if expansion in Top-Down mode

Fig. 5 – OPEN HOLE LINER